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ABSTRACT

This study is a presentation of findings which indicate the relationship between performance scores on the Remedial Developmental Studies (RDS) mathematics curriculum and grades in a specific college level course in College Algebra for students enrolled at Tennessee Technological University. Results indicated that students who had completed the RDS curriculum compared favorably in achievement with students who were not required to take RDS courses in mathematics. These differences were not statistically significant at the 0.05 level of significance. Overall grade point average for the RDS group was 2.31 for the quarter compared to 2.43 for the non-RDS group, again not statistically significant at the 0.05 level. The Pearson correlation coefficient between grade in RDS mathematics and final grade for the college mathematics course was 0.42. In addition, American College Test (ACT) scores and gender were examined as predictor variables. Lists 18 references. (Author/YP)

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RDS MATHEMATICS AS A PREDICTOR OF COLLEGE MATHEMATICS

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of the Tennessee Academy of Science

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ABSTRACT

This study is a presentation of findings which indicate the relationship between performance scores on the Remedial Developmental Studies (RDS) mathematics curriculum and grades in a specific college level course in College Algebra for students enrolled at Tennessee Technological University. Results indicated that students who had completed the RDS curriculum (Mean = 2.32) compared favorably in achievement with students who were not required to take RDS courses in mathematics (Mean = 2.51). These differences were not statistically significant at the 0.05 level of measurement. Overall GPA for the RDS group was 2.31 for the quarter compared to 2.43 for the non-RDS group, not statistically significant at the 0.05 level. The Pearson correlation coefficient between grade in RDS mathematics and final grade for the college mathematics course was 0.42.

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INTRODUCTION

For years, colleges throughout the country have been struggling with various degrees of success to address the inadequacy of mathematical skills brought to postsecondary institutions by entering freshmen and returning adult students. Almost every college and university in the United States offers some type of remediation in mathematics.

The primary aim of postsecondary mathematics remediation is to sufficiently improve the mathematical skills of remedial students so that they can successfully complete college-level mathematics or mathematics-dependent courses. The expectation is that successful remediation will allow the same opportunity of success to remedial students as is available to students not requiring remediation (Wepner, 1985).

Remedial and Developmental Studies (RDS) courses are offered, by mandate, at all Tennessee State Board of Regents institutions, including Tennessee Technological University. These programs are designed to provide academic support for students whose Academic Assessment and Placement Program (AAPP) scores indicate a need for additional preparation before entering regular college-level courses.

All freshman students seeking regular admission to Tennessee Technological University must participate in the AAPP as a condition for enrollment. An applicant of 21 years of age or younger who applies for regular freshman admission must submit an official ACT score. Students whose performance on the ACT and/or the AAPP component tests indicates a deficiency in ability to succeed in regular college-level work are placed at the appropriate competency level for remediation.

The purpose of this study was to assess the effectiveness of the Remedial and Developmental Studies program in mathematics at Tennessee Technological University. This study examined and compared the progress of remedial and developmental students after they had completed one or more

remedial mathematics courses and MATH 101, Algebra.

REVIEW OF RELATED LITERATURE

In a study conducted at Rampo College in New Jersey, students who had successfully completed the mathematics remedial developmental course and students who did not require remediation were compared. The results showed that remedial students did significantly better on an algebra posttest than did the students who were placed directly into the regular college-level mathematics. A considerable difference was found at the .01 prediction level when comparing the algebra posttest scores for the two groups. This difference was in favor of the remedial students. Further results indicate that eighty-one percent of the remedial developmental students successfully completed college-level mathematics as compared to only eighty percent of the non-remedial students. This was determined in an analysis of the final grades achieved in a college algebra course (Wepner, 1985).

In the spring 1985 through spring 1986 period, a study was conducted to evaluate the effectiveness of the remedial programs at William Rainey Harper College. The method used was to follow the progress of the students after they had completed a remedial course. It was shown that the students who did well in remedial courses were more likely to earn a higher overall grade point average and persisted longer at the college than those students who did not do well in the remedial program or did not participate in the program (Kolzow, 1986).

June R. Sparks and Cynthia L. Davis (1977) evaluated the developmental education program at Dalton Junior College (Georgia). This was accomplished by comparing the performance of the Special Studies students with that of regular college students with respect to their grades. A summary of the study indicated that when the Special Studies students moved into regular credit courses, they performed as well as the regular students in those classes.

At Augusta College in Georgia, Ping-Tung Chang (1983) conducted a national survey to try to determine and understand practically every aspect of remedial programs across the country. Two hundred questionnaires were sent to remedial instructors soliciting information on teaching techniques, student evaluation, course offerings, faculty qualification, classroom resources, math labs, time limits on remediation, follow-up studies, and the future of remedial programs. The study findings were based on a seventy-three percent response rate. The data collected from the survey showed that of the schools responding, forty-six to complete at least one college-level mathematics course after remediation.

An investigation performed by L. Quinn Head and Jimmy D. Lindsey (1984) was designed to examine, using statistical methods, the effectiveness of one remedial mathematics technique adopted by a four-year, accredited university. The independent variable was group classification. The groups were structured by means of registration data. The dependent variable was the final letter grade in college algebra. The Kruskel-Wallis One-Way Analysis of Variance and Mann-Whitney U Test procedures were used to correlate the data and make pair-wise comparisons. The analysis of variance revealed that there was a significant difference in the remedial students' final college algebra grades. This indicates some support for the idea that students acquiring the necessary math skills to pass remedial math have a much greater probability of passing college algebra than do students who do not have the math skills to pass remedial math.

An investigation was done to determine whether or not students who had completed a basic skills course demonstrated higher levels of academic performance when compared to regular students. Researchers found that remedial programs did have a positive short-term and long-term effect on academic performance (Behrman et al., 1984).

A meta-analytic synthesis of findings from sixty evaluation studies showed that special college programs for high-risk students have had basically positive effects on the students. High-risk students who enrolled in such programs stayed in college somewhat longer than control students did, and they received somewhat better grades in regular college work. Although such program effects were statistically reliable, they were fairly small in size in the typical study. The size of the effect varied, however, as a function of the type and the age of the program being evaluated (Kulik et al., 1983).

A study was done to determine what percentage of students entering teacher education needed remedial instruction in basic high school mathematics, and what impact the remedial instruction had on those students. Fifty-four freshmen from Eastern Kentucky University who were planning to major in teacher education were given a twenty-item pretest assessing basic high school mathematics concepts. Ten students (19%) were able to pass at the minimum competency level of eighty-five percent; the remaining forty-four students were enrolled in the remedial mathematics course. A posttest was administered at the end of the remedial instruction. The results of a t-test on gain scores indicated a statistically significant difference in the students' ability and comprehension level (Lee et al., 1985).

An evaluation was done of a remedial college course in intermediate algebra designed to improve student success rate. A method of teaching was developed that combined individualized instruction with the traditional lecture approach. The method was easy and inexpensive to implement, and required a minimum of reorganization. The results of the evaluation objectively demonstrated the success of the math-lab approach. Subjectively, the instructors and student attitudes indicated approval of the new method (Petricing, 1988).

Not all studies comparing remedial and non-remedial students have resulted in the previously mentioned conclusions. The academic success of students enrolled in remedi-

al English and remedial mathematics programs was compared at two large state universities, California State University, Northridge, and San Diego State University. The longitudinal success measures were annual pass-fail rates and persistence rates. English remedial and non-remedial students were grouped into three SAT-Verbal score categories, while mathematics remedial and non-remedial students were grouped within three SAT-Math score categories. No significant differences were found in the persistence rates of the remedial English or math students, when compared with non-remedial groups at either campus. Significant differences were found in the pass-fail rates of the remedial and the non-remedial students at both campuses (McCornak, 1985).

A study was undertaken to assess the effectiveness of remedial mathematics and language arts classes in a rural northern California community college district. Data related to remedial class completion, following semester return rates, units completed, grade point average (GPA), and declared major were collected for all remedial students taking language arts or mathematics courses in Fall 1981, Spring 1982, and Fall 1982. The study's results, based on an overview of the three terms, indicated that remedial students had a retention rate at slightly less than the comparable student population. The study also showed that, based on their GPA, remedial students were performing about "average" (Gash, 1983).

Another study described the programs in basic skills in mathematics at nine senior college and eight community colleges of the City University of New York (CUNY), updating surveys conducted in 1976. These programs are for students who do not meet CUNY's standard for minimum competency in mathematics, or higher standards set by the college in which they are enrolled. For each college, course structure and content, placement and population, teaching methods, support services, exit criteria and re-testing provisions, faculty, and response to the CUNY Mathematics Assessment Test (CMAT) were described (Hecht, 1982).

Cassandra B. Whyte (1985) conducted a national survey to collect information about services for students who were underprepared. Three hundred questionnaires were sent to deans of student affairs, directors of learning centers, and directors of developmental education at randomly selected colleges and universities ranging in population from 500 to 40,000 students. There was a forty-nine percent response rate. The results of this survey indicated that most colleges and universities offer an abundance of support services to aid academically underprepared students.

The task of selecting students who are most likely to succeed in a college Developmental Studies program results in important consequences for individuals and institutions. This study compared the accuracy of high school grade point average and Scholastic Aptitude Test scores in predicting freshman grade point average (freshman GPA) for two groups of students, Developmental Studies freshmen and regularly admitted freshmen. The procedure used to analyze the data was multiple regression. This method indicated that differences in slopes of the regression equations accounted for a small amount of criterion variance; however, there was substantially greater error variance in the predictor-criterion relationship for developmental students. The predictor variables for regular students accounted for thirty-four percent of the variance in freshman GPA which was about two-and-a-half times more variance than was accounted for by the predictors for developmental students. This implies that the estimation of freshmen grade point averages based on the prediction variables of high school grade point averages and Scholastic Aptitude Test scores were more accurate for the regularly admitted freshmen (Evin et al., 1984).

RESEARCH METHODOLOGY

Students who had successfully completed the Remedial and Developmental Studies mathematics course 084 at Tennessee Technological University were compared to non-remedial students by utilizing the mathematics grades on the class roles of an introductory college algebra class. Remedial

students who completed Math 101, Algebra, during Winter 1989, and received a grade of A, B, C, D, or F were designated as the RDS comparison group. For comparison, the non-RDS group consisted of the remaining non-remedial students in the five sections of Math 101, Algebra, Winter 1989. The data used were obtained from the students' permanent record files and from the Remedial and Developmental Studies program's records. A t-test was used to test the hypothesis that remedial students perform as well as non-remedial students. The Pearson correlation coefficient was calculated to ascertain the best predictor of success for remedial students in Math 101, Algebra.

There was a total 161 students enrolled in Math 101, Algebra, at the midpoint of Winter Quarter 1989. From these students, 124 were used in the analysis. The RDS group consisted of 56 students while the non-RDS group contained the remaining 68 students. Eighteen of the 161 were excluded based on their receiving a final grade of W, withdrawal from class before the midpoint of the quarter. Two students were excluded based on their receiving a final grade of X, absent from the final exam. Four were excluded for incompletion of the course. Thirteen students were dropped because of incomplete permanent records.

The permanent record files of the remaining students in both groups were reviewed and the following information was extracted:

1. Type of admission;

2. ACT (American College Test) composite score;

3. ACT Mathematics subtest score;

4. The overall grade point average at the end of Winter Quarter 1989;

5. Gender.

The final grades for the five sections of Math 101, College Algebra, were taken directly from the grade sheets. For the students in the experimental group, final grades from RDS mathematics course 084 and the post-AAPP grades for the Intermediate Algebra subtest were received from the Remedial and Developmental Studies program.

The purpose of this study was to assess the effectiveness of the Remedial and Developmental Studies program in mathematics at Tennessee Technological University. A t-test was used to determine if remedial students perform as well as non-remedial students (the control group) in Math 101, Algebra. Comparisons were also made between male and female students, and between regular admission and transfer students. Correlational analysis was utilized for determining which variable was best in predicting success in Math 101, Algebra. These variables included:

(1) Math 101 final grades,

(2) ACT composite scores,

(3) ACT mathematics subtest scores,

(4) overall grade point averages at the end of Winter Quarter 1989,

(5) post-AAPP subtest grades for Intermediate Algebra, and

(6) final grades for Remedial and Developmental Studies mathematics course 084.

The t-statistic at the 0.05 level of significance was used to establish whether to reject each of the following null hypotheses:

1. There is no statistically significant difference between final grades in Math 101, Algebra, for remedial students and non-remedial students.

2. There is no statistically significant difference between ACT composite scores for remedial students and non-remedial students.

3. There is no statistically significant difference between ACT Mathematics subtest scores for remedial students and non-remedial students.

4. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for remedial students and non-remedial students.

5. There is no statistically significant difference between final grades in Math 101, Algebra, for female students and male students.

6. There is no statistically significant difference between ACT composite scores for female students and male students.

7. There is no statistically significant difference between ACT Mathematics subtest scores for female students and male students.

8. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for female students and male students.

9. There is no statistically significant difference between the final grades for Remedial and Developmental Studies mathematics course 084 for female students and male students.

10. There is no statistically significant difference between the post-AAPP Intermediate Algebra subtest score for female students and male students.

11. There is no statistically significant difference between final grades in Math 101, Algebra, for regularly admitted students and transfer students.

12. There is no statistically significant difference between ACT composite scores for regularly admitted students and transfer students.

13. There is no statistically significant difference between ACT Mathematics subtest scores for regularly admitted students and transfer students.

14. There is no statistically significant difference between overall grade point average for regularly admitted students and transfer students.

15. There is no statistically significant difference between final grades in Math 101, Algebra, for remedial female students and remedial male students.

16. There is no statistically significant difference between ACT composite scores for remedial female students and remedial male students.

17. There is no statistically significant difference between ACT Mathematics subtest scores for remedial female students and remedial male students.

18. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for remedial female students and remedial male students.

19. There is no statistically significant difference between final grades in the Remedial and Developmental Studies mathematics course 084 for remedial female students and remedial male students.

20. There is no statistically significant difference between the post-AAPP Intermediate Algebra subtest score for remedial female students and remedial male students.

21. There is no statistically significant difference between final grades in Math 101, Algebra, for non-remedial female students and non-remedial male students.

22. There is no statistically significant difference between ACT composite scores for non-remedial female students and non-remedial male students.

23. There is no statistically significant difference between ACT Mathematics subtest scores for non-remedial female students and non-remedial male students.

24. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter for non-remedial female students and non-remedial male students.

25. There is no statistically significant difference between final grades in Math 101, Algebra, for female remedial students and female non-remedial students.

26. There is no statistically significant difference between ACT composite scores for female remedial students and female non-remedial students.

27. There is no statistically significant difference between ACT Mathematics subtest scores for female remedial students and female non-remedial students.

28. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for female remedial students and female non-remedial students.

29. There is no statistically significant difference between final grades in Math 101, Algebra, for male remedial students and male non-remedial students.

30. There is no statistically significant difference between ACT composite scores for male remedial students and male non-remedial students.

31. There is no statistically significant difference between ACT Mathematics subtest scores for male remedial students and male non-remedial students.

32. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for male remedial students and male non-remedial students.

PRESENTATION OF FINDINGS

The grouping variables used in this study were the classifications remedial students (experimental group) and non-remedial students (control group), female students and male students, and regularly admitted students and transfer students. Combinations of these grouping variables were also examined. The grouping variables were assigned the following names:

X1 = Remedial students

X2 = Non-remedial students

X3 = Female students

X4 = Male students

X5 = Regularly admitted students

X6 = Transfer students

X7 = Remedial female students

X8 = Remedial male students

X9 = Non-remedial female students

X10 = Non-remedial male students

X11 = Female remedial students

X12 = Female non-remedial students

X13 = Male remedial students

X14 = Male non-remedial students.

The dependent variables used in this study were the final grade for Math 101, Algebra, ACT composite score, ACT Mathematics subtest score, overall grade point average at the end of Winter Quarter 1989, the final grade for Remedial and Developmental Studies mathematics course 084, and the post-AAPP Intermediate Algebra subtest score. The dependent variables were assigned:

Y1 = Final grade in Math 101, Algebra

Y2 = ACT composite score

Y3 = ACT Mathematics subtest score

Y4 = Overall grade point average at the end of Winter Quarter 1989

Y5 = Final grade in RDS mathematics course 084

Y6 = Post-AAPP Intermediate Algebra subtest score.

The results of the analysis are shown in Table 1. These results are expressed as means (averages), degrees of freedom (DF), and significance (the two-tailed significance probability).

TABLE 1

Results from T-Test Analysis Comparing Each Dependent Variable by Each Independent Variable

Criterion	Hypotheses Tested	Mean 1 and N Cases	Mean 2 and N Cases	DF	t statistics	Significance
Y1	X1 = X2	2.32 56	2.51 68	122	0.8340	0.4059
Y2	X1 = X2	15.75 56	19.38 68	122	4.8580	0.0001
Y3	X1 = X2	10.68 56	17.53 68	122	8.7836	0.0001
Y4	X1 = X2	2.31 56	2.43 68	122	0.9558	0.3411
Y1	X3 = X4	2.70 69	2.09 55	122	2.6727	0.0086
Y2	X3 = X4	17.26 69	18.35 55	122	1.3352	0.1843
Y3	X3 = X4	13.26 69	15.91 55	122	2.7330	0.0072
Y4	X3 = X4	2.53 69	2.18 55	122	2.9059	0.0043
Y5	X3 = X4	2.59 38	2.08 18	54	2.9179	0.0051
Y6	X3 = X4	16.64 36	16.94 16	50	0.2373	0.8134
Y1	X5 = X6	2.42 109	2.47 15	122	0.1259	0.9000
Y2	X5 = X6	17.75 109	17.67 15	122	0.0687	0.9453
Y3	X5 = X6	14.36 109	15.00 15	122	0.4226	0.6733
Y4	X5 = X6	2.34 109	2.60 15	122	1.3581	0.1769

TABLE 1 (Con't)

Results from T-Test Analysis Comparing Each Dependent Variable by Each Independent Variable

Criterion	Hypotheses Tested	Mean 1 and N Cases	Mean 2 and N Cases	DF	t statistics	Significance
Y1	X7 = X8	2.47 38	2.00 18	54	1.4390	0.1559
Y2	X7 = X8	16.21 38	14.78 18	54	1.2175	0.2287
Y3	X7 = X8	10.42 38	11.22 18	54	0.7219	0.4735
Y4	X7 = X8	2.39 38	2.14 18	54	1.6635	0.1020
Y5	X7 = X8	2.59 38	2.08 18	54	2.9179	0.0051
Y6	X7 = X8	16.64 36	16.94 16	50	0.2373	0.8134
Y1	X9 = X10	2.97 31	2.14 37	66	2.5873	0.0119
Y2	X9 = X10	18.55 31	20.08 37	66	1.5305	0.1307
Y3	X9 = X10	16.74 31	18.19 37	66	1.2798	0.2051
Y4	X9 = X10	2.69 31	2.20 37	66	2.7343	0.0080
Y1	X11 = X12	2.47 38	2.97 31	67	1.8630	0.0668
Y2	X11 = X12	16.21 38	18.55 31	67	2.3949	0.0194
Y3	X11 = X12	10.42 38	16.74 31	67	5.4596	0.0001
Y4	X11 = X12	2.39 38	2.69 31	67	1.8411	0.0700
Y1	X13 = X14	2.00 18	2.14 37	53	0.3320	0.7412
Y2	X13 = X14	14.78 18	20.08 37	53	4.3823	0.0001
Y3	X13 = X14	11.22 18	18.19 37	53	6.6577	0.0001
Y4	X13 = X14	2.14 18	2.20 37	53	0.3657	0.7161

These results indicate that there was no statistical significance between the final grades for Math 101, Algebra, for remedial students (the experimental group) and non-remedial students (the control group), regularly admitted students and transfer students, remedial female and male students, female remedial and non-remedial students, and male remedial and non-remedial students. The ACT composite scores for female and male students, regularly admitted students and transfer students, and remedial female and male students showed no statistically significant difference. The ACT Mathematics subtest score for regularly admitted students and transfer students, remedial female and male students, and non-remedial female and male students also showed no statistically significant difference.

No statistically significant difference was shown for remedial and non-remedial students, regularly admitted students and transfer students, remedial female and male students, female remedial and non-remedial students, and male remedial and non-remedial students based on their overall grade point average at the end of Winter Quarter 1989. No statistically significant difference was shown for remedial female and male students based on their post-AAPP Intermediate Algebra subtest grade.

Based on these results, the following null hypotheses (1, 4, 6, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, 23, 25, 28, 29, and 32) were not rejected:

1. There is no statistically significant difference between final grades in Math 101, Algebra, for remedial students and non-remedial student.

2. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for remedial students and non-remedial students.

3. There is no statistically significant difference between ACT composite scores for female students and male students.

4. There is no statistically significant difference between the post-AAPP Intermediate Algebra subtest score for female students and male students.

5. There is no statistically significant difference between final grades in Math 101, Algebra, for regularly admitted students and transfer students.

6. There is no statistically significant difference between ACT composite scores for regularly admitted students and transfer students.

7. There is no statistically significant difference between ACT Mathematics subtest scores for regularly admitted students and transfer students.

8. There is no statistically significant difference between overall grade point average for regularly admitted students and transfer students.

9. There is no statistically significant difference between final grades in Math 101, Algebra, for remedial female students and remedial male students.

10. There is no statistically significant difference between ACT composite scores for remedial female students and remedial male students.

11. There is no statistically significant difference between ACT Mathematics subtest scores for remedial female students and remedial male students.

12. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for remedial female students and remedial male students.

13. There is no statistically significant difference between the post-AAPP Intermediate Algebra subtest score for remedial female students and remedial male students.

14. There is no statistically significant difference between ACT composite scores for non-remedial female students and non-remedial male students.

15. There is no statistically significant difference between ACT Mathematics subtest scores for non-remedial female students and non-remedial male students.

16. There is no statistically significant difference between final grades in Math 101, Algebra, for female remedial students and female non-remedial students.

17. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for female remedial students and female non-remedial students.

18. There is no statistically significant difference between final grades in Math 101, Algebra, for male remedial students and male non-remedial students.

19. There is no statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for male remedial students and male non-remedial students.

All other hypotheses were shown to have a statistically significant difference when tested. Therefore, the null hypothesis 2, 3, 5, 7, 8, 9, 19, 21, 24, 26, 27, 30, and 31 were rejected at the 0.05 level of significance, and the following conclusions were reached:

1. There is a statistically significant difference between ACT composite scores for remedial students and non-remedial students.

2. There is a statistically significant difference between ACT Mathematics subtest scores for remedial students and non-remedial students.

3. There is a statistically significant difference between final grades in Math 101, Algebra, for female students and male students.

4. There is a statistically significant difference between ACT Mathematics subtest scores for female students and male students.

5. There is a statistically significant difference between overall grade point averages at the end of Winter Quarter 1989 for female students and male students.

6. There is a statistically significant difference between the final grades for Remedial and Developmental Studies mathematics course 084 for female students and male students.

7. There is a statistically significant difference between final grades in the Remedial and Developmental Studies mathematics course 084 for remedial female students and remedial male students.

8. There is a statistically significant difference between final grades in Math 101, Algebra, for non-remedial female students and non-remedial male students.

9. There is a statistically significant difference between overall grade point averages at the end of Winter Quarter for non-remedial female students and non-remedial male students.

10. There is a statistically significant difference between ACT composite scores for female remedial students and female non-remedial students.

11. There is a statistically significant difference between ACT Mathematics subtest scores for female remedial students and female non-remedial students.

12. There is a statistically significant difference between ACT composite scores for male remedial students and male non-remedial students.

13. There is a statistically significant difference between ACT Mathematics subtest scores for male remedial students and male non-remedial students.

The correlation matrices show the Pearson product-moment correlation. Correlation measures the closeness of a linear relationship between two variables. In this analysis the matrices were computed by using the final grade in Math 101, Algebra, the ACT composite score, the ACT Mathematics subtest score, the overall grade point average, the final grade in the Remedial and Developmental Studies mathematics course 084, and the post-AAPP Intermediate Algebra subtest score. Only variables significant to the classification group were used for that correlation analysis.

For the remedial students (the experimental group) and the non-remedial students (the control group), only the

final grade in Math 101, Algebra, the ACT composite score, the ACT Mathematics subtest score, and the overall grade point average was used. The results of the correlation analysis appear in Table 2. When the correlation coefficient for both groups was examined, no variable had a correlation coefficient that indicated it was a good predictor of the final grade in Math 101, Algebra.

Using only the remedial students (the experimental group), the variables used were the final grade in Math 101, Algebra, the ACT composite score, the ACT Mathematics subtest score, the overall grade point average, and the final grade in Remedial and Developmental Studies mathematics course 084. The highest correlation that exists between the final grade in Math 101, Algebra, and the remaining predictor variables was the final grade in the RDS mathematics course 084 with a correlation coefficient of $r = 0.42$. These results are shown in Table 3.

In the case of the non-remedial students (the control group), female students, and male students, the predictor variables were the final grade in Math 101, Algebra, the ACT composite score, the ACT Mathematics subtest score, and the overall grade point average. The results showed no variable as a good predictor for the final grade in Math 101, Algebra. This is represented in Table 4.

For the group classification of female students, again, no variable stand out as a good predictor of the final grade in Math 101, Algebra. This is shown in Table 5. For the group classification of male students, the outcome was the same as with the female students. Table 6 shows these results.

The predictor variables for the group classifications of female remedial students and male remedial students are the final grade in Math 101, Algebra, the ACT composite score, the ACT Mathematics subtest score, the overall grade point average, and the final grade in Remedial and Developmental Studies mathematics course 084. For the female

remedial students, the results are shown in Table 7. As before there is no specific variable that could be used as a predictor of the final grade in Math 101, Algebra. For the male remedial students, the best predictor of the final grade in Math 101, Algebra, is the final grade in the Remedial and Developmental Studies mathematics course 084 with a correlation coefficient of $r = 0.52$. Table 8 presents these results.

TABLE 2

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), and Final Grades in Math 101, Algebra (FINAL)
Remedial and Non-Remedial Students
N = 124

	ACTCOMP	ACTMATH	QPA	FINAL
ACTCOMP	1.00	0.72	0.17	0.07
ACTMATH		1.00	0.06	0.17
QPA			1.00	0.51
FINAL				1.00

TABLE 3

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), Final Grades in RDS Mathematics Course 084 (RDSGR), and Final Grades in Math 101, Algebra (FINAL)
Remedial Students - N = 56

	ACTCOMP	ACTMATH	QPA	RDSGR	FINAL
ACTCOMP	1.00	0.61	0.36	0.23	0.05
ACTMATH		1.00	0.26	0.17	0.11
QPA			1.00	0.49	0.47
RDSGR				1.00	0.42
FINAL					1.00

TABLE 4

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), and Final Grades in Math 101, Algebra (FINAL)
Non-Remedial Students
N = 68

	ACTCOMP	ACTMATH	QPA	FINAL
ACTCOMP	1.00	0.69	0.03	0.05
ACTMATH		1.00	-0.111	0.18
QPA			1.00	0.53
FINAL				1.00

TABLE 5

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), and Final Grades in Math 101, Algebra (FINAL)
Female Students
N = 69

	ACTCOMP	ACTMATH	QPA	FINAL
ACTCOMP	1.00	0.69	0.27	0.15
ACTMATH		1.00	0.17	0.24
QPA			1.00	0.59
FINAL				1.00

TABLE 6

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), and Final Grades in Math 101, Algebra (FINAL)
Male Students
N = 55

	ACTCOMP	ACTMATH	QPA	FINAL
ACTCOMP	1.00	0.77	0.13	0.06
ACTMATH		1.00	0.56	0.24
QPA			1.00	0.27
FINAL				1.00

TABLE 7

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), Final Grade in RDS Mathematics Course 084 (RDSGR), and Final Grades in Math 101, Algebra (FINAL)
Female Remedial Students
N = 38

	ACTCOMP	ACTMATH	QPA	RDSGR	FINAL
ACTCOMP	1.00	0.65	0.26	0.20	-0.042
ACTMATH		1.00	0.30	0.33	0.07
QPA			1.00	0.61	0.55
RDSGR				1.00	0.34
FINAL					1.00

TABLE 8

Pearson Product-Moment Correlations for ACT Composite Scores (ACTCOMP), ACT Mathematics Subtest Scores (ACTMATH), Overall Grade Point Average (QPA), Final Grade in RDS Mathematics Course 084 (RDSGR), and Final Grades in Math 101, Algebra (FINAL)
Male Remedial Students
N = 18

	ACTCOMP	ACTMATH	QPA	RDSGR	FINAL
ACTCOMP	1.00	0.64	0.52	0.17	0.12
ACTMATH		1.00	0.28	-0.043	0.29
QPA			1.00	-0.014	0.16
RDSGR				1.00	0.52
FINAL					1.00

DISCUSSION OF FINDINGS

The purpose of this study was to assess the effectiveness of the Remedial and Developmental Studies program in mathematics at Tennessee Technological University. This comparison allowed the researcher to determine, to some degree, the impact of the remedial program on its students. The researcher also was interested in the best predictor of the final grade in an introductory algebra class.

The data gathered were subjected to a t-test and a correlational test. The t-test was done to determine if a statistically significant difference existed between the

experimental group and the control group. The correlation was used to discover the relationship between the variables.

Based on the analysis done, it was found that between the remedial students (the experimental group) and the non-remedial students (the control group), there was no statistically significant difference in their final grades for Math 101, Algebra or in their overall grade point averages at the end of Winter Quarter 1989. However, there was a statistically significant difference in their ACT composite scores and their ACT Mathematics subtest scores. This indicated that while the remedial students and the non-remedial students varied significantly in their academic performance, particularly in mathematics related areas, before attending college, the remedial students performed as well as the non-remedial students in Math 101, Algebra.

When comparing the female students with the male students, only the ACT composite scores and the post-AAPP Intermediate Algebra subtest scores (remedial students only) showed no statistically significant difference. Their final grades in Math 101, Algebra, their ACT Mathematics subtest scores, their overall grade point at the end of Winter Quarter 1989, and their final grade in RDS mathematics course 084 (remedial students only) showed a significant difference. The female students' mean of the overall grade point averages at the end of Winter Quarter 1989 was higher than the mean of the male students overall grade point average. This indicated that while the female students performed poorly when compared to the male students in mathematics related areas, their overall performance was better.

In the comparison of the regularly admitted students and the transfer students, no statistically significant difference was found in their final grades in Math 101, Algebra, their ACT composite scores, their ACT Mathematics subtest scores, or their overall grade point average at the end of Winter Quarter 1989.

When comparing the remedial students (the experimental group) by gender, no statistically significant difference was found in their final grades in Math 101, Algebra, their ACT composite scores, their ACT Mathematics subtest scores, their overall grade point average at the end of Winter Quarter 1989, or their post-AAPP Intermediate Algebra subtest scores. However, there was a statistically significant difference in their final grades in the RDS mathematics course 084. The mean of the final grades in the RDS mathematics course 084 was higher for the female students than for the male students.

A comparison of non-remedial female students with non-remedial male students resulted in a statistically significant difference between their final grades in Math 101, Algebra, and between their overall grade point averages. However, there was no statistically significant difference in their ACT composite scores or in their ACT Mathematics subtest scores. This indicated that non-remedial female students performed better in classroom situations than the non-remedial male students. However, their performance on standardized tests was approximately equal.

When comparing female remedial students with female non-remedial students, there was no statistically significant difference in their final grades in Math 101, Algebra, and their overall grade point averages at the end of Winter Quarter 1989. There were, however, statistically significant differences in their ACT composite scores and in their ACT Mathematics subtest scores. This indicated that while the female students varied greatly in their academic performance before entering college, the female remedial students performed as well as the female non-remedial students in Math 101, Algebra. A comparison of male remedial students and male non-remedial students showed the same results. These results supported the findings from the comparison of remedial students and non remedial students.

The Pearson product-moment correlation was used to determine the best predictor of success in Math 101, Algebra, for remedial students (the experimental group) and for non-remedial students (the control group). A correlation test was performed on the significant predictor variables for the following groups:

1. Remedial and non-remedial students,
2. Remedial female and male students,
3. Non-remedial female and male students,
4. Female remedial and non-remedial students,
5. Male remedial and non-remedial students,
6. Female remedial students,
7. Male remedial students.

The resulting correlation coefficients indicated, with two exception, that there was not a good predictor of success in Math 101, Algebra. The exceptions were remedial students and male remedial students. The correlation test indicated that for these students, the final grade in the RDS mathematics course 084 was a predictor of success in Math 101, Algebra. It should be noted that for female remedial students the same variable, the final grade in the RDS mathematics course 084, showed some correlation with the final grade in Math 101, Algebra. The relationship was not sufficient to consider the variable as a predictor.

An unexpected result of the correlation analysis was the lack of a strong relationship between the final grades in Math 101, Algebra, and the ACT composite scores. None of the groups tested showed any significant correlation between these variables. The correlation coefficient for the final grades in Math 101, Algebra, and the ACT Mathematics subtest scores showed a only slight relation for all groups examined.

It was expected that the correlation between these two sets of variables would be weak for the remedial students, as this is the criterion used for placement in the Remedial and Developmental Studies program at Tennessee Technological University. However, the weak relationship shown between the variables for the non-remedial students was not foreseen. These results are contradictory to the accepted practice of using the ACT composite score as a good predictor of success in college and to the accepted practice of using the ACT Mathematics subtest score as a good predictor of success in college mathematics courses.

The results of this study presented evidence that the Remedial and Developmental Studies program in mathematics at Tennessee Technological University is functioning in accordance with the aim of a college remediation program. The remedial students performed as well as the non-remedial students in Math 101, Algebra, during Winter Quarter 1989.

The correlation tests showed none of the variables used for the analysis could be considered good predictors of either remedial or non-remedial students' final grades in Math 101, Algebra. The analysis, however, indicated that the practice of using the ACT composite score and the ACT Mathematics subtest score as predictors of success in Math 101, Algebra, may need to be reconsidered.

It is recommended that this study be conducted again using a random sample to determine if the results are valid. Specific attention should be placed on the use of the ACT composite score and ACT Mathematics subtest score as predictors of success in an introductory college algebra course.

Another area of study could be directed toward the effects of delay between completion of the remediation mathematics program and the completion of an introductory college algebra course.

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